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COAL MEASURES FAUNAL STUDIES, IV.
J. W. Beede and Austin F. Rogers.

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VOL. III, No. 10. APRIL, 1906. WHOLE SERIES, VOL XIII, No. 10.

COAL MEASURES FAUNAL STUDIES, IV.

UPPER COAL MEASURES, Neosho River Section.

BY J. W. BEEDE AND AUSTIN F. ROGERS.*

THIS paper is a continuation of the others of similar title by the authors, and takes up the rocks of the southeastern part of the state where No. III left off, (No. 15, vol. II).

DUDLEY SHALES.

One hundred and fifty feet of shales from which no fossils have, with certainty, been collected. Some were collected from clay shales at Parsons, but we are not certain of the horizon from which they came.

HERTHA LIMESTONE.

Bluish to light gray limestone with shale partings. From ten to twenty feet in thickness. The fossils accredited to this limestone were collected from the Santa Fe railroad cut just east of Trent siding, three miles east of Erie.

Sponge?.
Aulopora sp.
Axophyllum rude White and St. John, c.
sp.
Campophyllum torquium Owen.
Lophophyllum westii Beede, aa.
Crinoid plates and stems.
Archæocidaris, two or three species.
Serpula insita White.
Spirorbis cf. nodulosus Hall.
sp.
Hederella ? sp., a.
Chainodictyon laxum Foerste.
Cystodictya inequimarginata Rogers.
Fenestella limbata Foerste.
sp.
Fistulipora nodulifera Meek.
Pinnatopora sp.
Polypora, two species.
Rhombocladia delicata Rogers, c.
Rhombopora lepidodendroides Meek.
Stenopora carbonaria Worthen.
Ambocœlia planoconvexa (Shumard), c.

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Chonetes flemmingi Norwood and Pratten, a.
Crania sp., c.
Derbya crassa (Meek).
keokuk (Hall)?.
Dielasma bovidens (Morton), c.
Orbiculoidea convexa (Shumard).
Productus cora d'Orbigny.
longispinus (Sowerby), aa.
nebrascensis Owen.
pertenuis Meek, c.
punctatus (Martin).
semireticulatus (Martin).
Pugnax rockymontanus (Marcou)?.
utah (Marcou).
Reticularia perplexa (McChesney).
Rhipidomella pecosi (Marcou).
Seminula argentea (Shepard), c.
Spirifer cameratus Morton, c.
Spiriferina kentuckiensis (Shumard).
Aviculopecten carboniferus (Stevens).
maccoyi Meek.
Aviculopinna illinoisensis Worthen.
Conocardium parrishi Worthen.
Edmondia? sp.
Limopteria longispina (Cox).
Pelecypod sp.
pinna-like.
Pernopecten sp.
Pseudomonotis sp.
Pteria longa (Geinitz) ??.
Bellerophon carbonarius (Cox).
percarinatus Norwood and Pratten.
Bulimorpha sp.
Gastropods, two or three species.
Pleurotomaria missouriensis Meek and Worthen.
two species.
Strophostylus nanus (Meek and Worthen).
two species.
Trachydomia wheeleri (Swallow).
Cephalopod sp.
Ephippoceras ferratus (Cox) ??.
Metacoceras sangamonensis (Meek and Worthen) ?.
Orthoceras sp.
Cyclus packardi Rogers.
Cypridina sp.
Cypridella sp.
Fish tooth.
Peripristis semicircularis (Meek) ?.

MOUND VALLEY LIMESTONE.

A limestone in several layers, aggregating ten or fifteen feet in thickness. The layers are separated by shaly partings. The fossils accredited to this horizon were collected from two localities, as follows: One on the west side of the Neosho river, where the wagon road leading west from the bridge just south of Erie rises from the river bottom; several layers are exposed in the road. The other locality is in the A. T. & S. F. railroad cut at the foot of the bluff about three miles west of Erie. The limestone is on the north side, near the track. At this point the layers are rather massive.

ROAD WEST OF RIVER.

Sponge sp.
Fenestella limbata Foerste.
Fistulipora nodulifera Meek.
Polypora sp.
Dielasma bovidens (Morton).
Productus cora d'Orbigny, c.
costatus (Sowerby).
nebrascensis (Owen), c.
pertenuis Meek.
Productus punctatus (Martin).
semireticulatus (Martin).
Reticularia perplexa (McChesney), c.
Seminula argentea (Shepard).
Spirifer cameratus (Morton).
Cypridina sp.
Cypridella sp.
Ostracod.

CUT WEST OF TOWN.

Lophophyllum westii Beede.
Archæocidaris sp.
Spirorbis cf. blairii Miller.
Fenestella sp.
Fistulipora nodulifera, c.
Pinnatopora sp.
Polypora elliptica Rogers, c.
three species.
Rhombocladia delicata Rogers.
Rhombopora sp.
Septopora biserialis (Swallow).
Stenopora carbonaria Worthen, c.
Derbya crassa (Meek and Hayden), c.
keokuk Hall.
Meekella striaticostata (McChesney)?.
Productus cora d'Orbigny, a.
longispinus (Sowerby).
nebrascensis Owen.
pertenuis Meek.
punctatus (Martin).
sp.
Reticularia perplexa (McChesney).
Seminula argentea (Shepard), aa.
Spirifer cameratus Morton, a.
Spiriferina kentuckiensis (Shum.), a.
Strophalosia spondyliformis White and St. John.
Allorisma sp.
Aviculopecten carboniferus (Stev.)
two species.
Edmondia sp.
Entolium aviculatum Swallow.
Lima retifera Shumard.
sp.
Myalina subquadrata Shumard, c.
swallowi McChesney.
Pleurophorus, two species.
Pseudomonotis kansasensis Beede?.
Pteria longa (Geinitz).
Schizodus curtiforme Walcott?.
Solenomya radiata Meek and Worthen.
Bellerophon sp.
Bulimorpha cf. nitidula (M. & W.)
sp.
Loxonema sp.
Pleurotomaria sp.
Soleniscus?, two species.
Strophostylus sp.
Straparollus sp.
Nautiloid.
Cypridina sp.
Phillipsia major Shumard.

DUDLEY SHALES.

From a few to a hundred feet in thickness. No fossils have been collected from these shales.

DENNIS LIMESTONE.

A light gray limestone, reaching a thickness of forty feet. Fossils were taken from this limestone from two localities—one at the top of the bluff at the A. T. & S. F. cut, west of Erie; and the other from the cut by same road just west of Shaw. These localities are so close and the possibility for mistake in the horizon so great that they are here grouped together.

Sponge? sp.
Lophophyllum westii Beede.
Archæocidaris megastylus Shumard.
sp.
Cystodictya inequimarginata Rogers, c.
Fenestella limbata Foerste, c.
remota Foerste.
sp.
Fistulipora nodulifera Meek.
Pinnatopora multipora Rogers.
trilineata (Meek).

Polypora elliptica Rogers.
sp.
Rhombocladia delicata Rogers.
Rhombopora sp., c.
Stenopora carbonaria Worthen, c.
Cleiothyris roissyi l'Eveille.
Crania modesta White and St. John.
Derbya crassa (Meek and Hayden).
Dielasma bovidens (Morton).
Hustedia mormoni (Marcou).
Proboscidella sp., a.
sp.
Productus costatus (Sowerby), a.
longispinus (Sowerby), aa.
muricatus Norwood and Pratten.
nebrascensis Owen.
pertenuis Meek, c.
punctatus (Martin), c.
Reticularia perplexa (McChesney), aa.
Seminula argentea (Shepard), aa.
Spirifer cameratus (Morton), c.
Spiriferina kentuckiensis (Shumard).
Allorisma granosum Shumard.
Aviculopecten carboniferus (Stev.)
hertzeri Meek.
occidentalis Shumard.
providencesis Cox.
Chænomya leavenworthensis Meek and Hayden.*
Concocardium parrishi Worthen.
Edmondia aspinwallensis Meek?.
Edmondia? sp.
Macrodon sangamonensis Worthen?.
Pleurophorus tropidophorus Meek.
Anomphalus rotulus M. & W.?
Bellerophon crassus M. & W.?
sp.
Euomphalus catilloides (Conrad).
Gastropod sp.
Pleurotomaria missouriensis Shum.*
tenuistriata Shum.
Strophostylus sp.
Ephippoceras? sp.
Orthoceras cribosum Geinitz.
Temnocheilus? sp.
Cypridella sp.
Cyrpidina sp.
Eutomis sp.

CHANUTE SHALES.

About 200 feet of shales with some sandstone. No fossils were collected from this horizon.

IOLA LIMESTONE.

Thirty feet of gray to almost white limestone. The fossils accredited to this horizon were from two localities—Chanute and the cement quarries at Iola. The studies of Professor Haworth and Doctor Adams led them to the conclusion that the limestone just west of Chanute was the base of the Iola limestone. The difference between the faunas of the Iola exposure and this one is so striking that they are given separately here.

ABOUT ONE MILE WEST OF CHANUTE.

Sponge? sp.
Lophophyllum westii Beede.
Archæocidaris sp.
Fenestella sp.
Fistulipora nodulifera Meek, c.
Polypora elliptica Rogers.
sp.
Rhombocladia delicata Rogers.
Ambocœlia planoconvexa (Shumard), a.

* This specimen was taken from the ballast in the cut, but is unquestionably from the limestone in which the cut is made.

Chonetes verneuilianus Norwood and Pratten.
Cleiothyris roissyi l'Eveille, ? c.
Cryptacanthia compacta White and St. John, a.
Derbya sp.
Dielasma bovidens (Morton).
Hustedia mormoni (Marcou).
Meekella striaticostata (McChesney), aa.
Productus pertenuis Meek.
punctatus (Martin).
semireticulatus (Martin).
sp.
Recticularia perplexa (McChesney), aa.
Seminula argentea (Shepard), a.
Spirifer cameratus Morton.
Spiriferina kentuckiensis (Shumard), aa.
Aviculopecten interlineatus Meek and Worthen.
Pelecypod sp.
Bulimorpha sp.
Capulus parvus Swallow.
Gastropod sp.

CEMENT WORKS AT IOLA.

Lophophyllum profundum (E. & H.), c.
westii Beede, aa.
Ceriocrinus missouriensis M. & G., c.
Ceriocrinus? sp.
Crinoid sp.
Erisocrinus typus M. & W.?, a.
Hydreionocrinus discus (M. & W.)?.
Phialocrinus? sp.
Serpula insita White.
Spirorbis blairii Miller.?
Cystodictya inequimarginata Rogers.
Fenestella limbata Foerste.
sp.
Fistulipora nodulifera Meek, aa.
Pinnatopora sp.
Polypora elliptica Rogers, c.
sp.
Rhombopora sp.
Rhombocladia delicata Rogers.
Septopora biserialis (Swallow).
Stenopora carbonaria Worthen.
Chonetes verneuilianus N. & P., c.
Cleiothyris roissyi l'Eveille.
Derbya crassa (Meek).
Dielasma bovidens (Morton), c.
Hustedia mormoni (Marcou), aa.
Meekella striaticostata (McChes.)
Proboscidella sp.
Productus cora d'Orbigny.
longispinus (Sowerby), aa.
pertenuis Meek, c.
punctatus (Martin).
Pugnax utah (Marcou).
sp.
Reticularia perplexa (McChesney), c.
Seminula argentea (Shepard), a.
Spirifer cameratus Morton, c.
Spiriferina kentuckiensis (Shumard), aa.
Strophalosia spondyliformis (White and St. John?).
Allorisma granosum (Shumard).
Aviculopecten interlineatus Meek and Worthen.
Entolium aviculatum (Swallow).
Lima retifera Shumard.
sp.
Macrodon sangamonensis Worthen?.
Modiola sp.
Bulimorpha cf. chrysalis Meek and Worthen.
Capulus parvus Swallow, c.
sp.
Gastropod, two species.
Trachydomia wheeleri (Swallow)?.
Milleroceras parishi Miller and Gurley?.
Nautiloid.
Orthoceras sp.
Cypridina sp.
Cypridella sp.
Griffithides scitula (Meek and Worthen).
Phillipsia? sp.*

*Girty states (Bull. 211, U. S. G. S., p. 75), " . . . *Enteletes* first appears in the Iola limestone, where it is abundant. . . ." As a matter of fact it should be stated that three days' collecting at the type locality, by the authors, failed to reveal a single specimen of this fossil. One of the authors, whose home was in Kansas City, on the ledge of the Iola limestone, during years of collecting, never saw a specimen of it in that horizon. It is altogether probable that, in time, it will be found in the Iola limestone, as in the next heavy

LANE SHALES.

About seventy-five feet of bluish shales, nearly non-fossiliferous save in some calcareous layers near their base. The fossils from this horizon were collected in these calcareous layers in the base of the shales at the brick-yards south of Iola.

Amblysiphonella? sp.
Sponges?, two species.
Lophophyllum profundum (Edwards and Haime).
westii Beede?.
Ceriocrinus? sp.
Crinoid sp.
Erisocrinus typus Meek and Worthen.
Fenestella sp.
Polypora sp.
Ambocœlia planoconvexa (Shumard).
Chonetes verneuilianus Norwood and Pratten.
Hustedia mormoni (Marcou), c.
Productus longispinus (Sowerby).
nebrascensis Owen.
Pugnax utah (Marcou).
Reticularia perplexa (McChesney).
Spirifer cameratus (Morton), c.
Spiriferina kentuckiensis (Shumard).
Aviculopecten occidentalis (Shumard).
Capulus parvus Swallow.
Naticopsis? sp.
Pleurotomaria sp.
Agassizodus variabilis Newberry and Worthen?.

ALLEN AND STANTON LIMESTONE AND OTHER FORMATIONS.

At the time of our visit the stratigraphy of the region north of Iola was not yet sufficiently well worked out to permit of collecting to the best advantage. All the formations above the Iola limestone, or their equivalents, are very much better exposed and vastly more fossiliferous and easily accessible along the Kansas river west from Kansas City. Any one desiring any adequate knowledge from a limited study of these formations and their faunas should confine their observations to the Kansas river section, if we except region around Cottonwood Falls. Under the above heading we include the limestones and shales above the Iola and below the Upper Oread at Burlington. The limestone forming an escarpment some few miles south of Burlington was not visited. Collections were made at the Allen limestone on top of the Lane shales at the Iola brick-yards, where twenty-eight of the following species were represented. The forms referred to as sponges in the list were confined to this locality. The rocks (three

persistent limestone above (the Garnett) it is extremely abundant. However, we have never seen it below that horizon. It should also be stated that Adams, who made the collections upon which Girty based his lists, admitted to the authors in the field that the specimens of *Enteletes* from Iola were collected from the ballast of the railroad at that place. That ballast was crushed at Garnett, from the Garnett limestone, in which it is very abundant. Consequently Girty's statement concerning it in Professional Paper No. 16, U. S. G. S., p. 264, and other places, is in error.

limestone horizons) at Carlyle contained representatives of fourteen of them, while a locality just a few miles west of Carlyle and south of east of Neosho Falls contained twenty of them. They are grouped here in one list, on account of the difficulty of correlation of horizons.

Fusulina sp.
Amblysiphonella? sp., aa.
Sponge? sp., large, a.
Sponge?, two small species, aa.
Lophophyllum profundum (Edwards and Haime).
westii Beede, a.
Ceriocrinus missouriensis Miller and Gurley.
Crinoid sp.
Erisocrinus typus Meek and Worthen?.
Phialocrinus stillativus (White)?.
Archæocidaris sp.
Fenestella sp.
Fistulipora nodulifera Meek.
Polypora elliptica Rogers.
submarginata Meek.
Rhombopora sp.
Septopora biserialis (Swallow).
Chonetes flemmingi Norwood and Pratten.
Derbya crassa (Meek).
sp.
Dielasma bovidens (Morton).
Enteletes hemiplicatus Hall, c.
Hustedia mormoni (Marcou), a.
Productus longispinus (Sowerby), a.
nebrascensis Owen.
punctatus (Martin), c.
sp.
symmetricus McChesney.
Pugnax utah (Marcou).
Reticularia perplexa (McChesney).
Rhipidomella pecosi (Marcou).
Seminula argentea (Shepard), aa.
Spirifer cameratus Morton. c.
Spiriferina kentuckiensis (Shumard), c.
Aviculopecten occidentalis (Shumard)?.
Entolium aviculatum (Swallow).
Myalina sp.
subquadrata Shumard?.
Nuculana bellistriata (Stevens).
Pelecypod sp.
Euomphalus sp.
Cephalopod sp.
Orthoceras sp.
Cladodus sp.

OREAD LIMESTONE.

The exposures at Burlington do not show the thickness of the Oread limestone nor the succession of layers. The portion collected from is probably the upper stratum, exposed in the city and in an old quarry two miles south of town, on the east side of the M. K. & T. railroad, by a little creek.

Fusulina sp.
Amblysiphonella? sp.
Sponge, two species, aa.
Aulopora? anna Beede?.
Lophophyllum profundum E. & H. ?
westii Beede, c.
Ceriocrinus missouriensis Miller and Gurley, c.
Hydreionocrinus discus M. & W.?
Crinoids, two or three species.
Archæocidaris sp.
Serpula insita White.
Cystodictya inequimarginata Rogers.
Fenestella limbata Foerste.
remota Foerste.
sp.
Fistulipora nodulifera Meek, a.
Pinnatopora whitei Foerste.
Polypora aspera? Rogers.
elliptica Rogers.
submarginata Meek.
Rhombocladia delicata Rogers.
Rhombopora sp.
Septopora biserialis (Swallow).

Stenopora carbonaria Worthen, c.
Streblotrypa prisca (Gabb and Horn).
Ambocœlia planoconvexa (Shum.), c.
Chonetes flemmingi N. & P.
granulifer Owen, c.
Derbya bennetti Hall and Clarke.
crassa (Meek).
keokuk (Hall).
Dielasma bovidens (Morton).
Enteletes hemiplicata Hall.
Hustedia mormoni (Marcou), a.
Meekella striaticostata (McChes.)
Proboscidella sp.
Productus cora d'Orbigny.
longispinus (Sowerby), a.
nebrascensis Owen.
pertenuis Meek, a.
punctatus (Martin).
semireticulatus (Martin).
Productus sp., c.
Pugnax utah (Marcou), c.
Reticularia perplexa (McChesney).
Rhipidomella pecosi (Marcou), a.
pecosi var.
Seminula argentea (Shepard), c.
Spirifer cameratus (Morton), c.
Spiriferina kentuckiensis (Shumard).
Nucula ventricosa Hall.
Gastropod sp.
Orthonema salteri Meek and Worthen ?.
Pleurotomaria sp.
sphærulata Conrad ?.
Orthoceras cribosum Geinitz, c.
Cypridina sp.
Cypridella sp.
Griffithides scitula Meek and Worthen.

EMPORIA LIMESTONE.

The interval between the Oread and Emporia limestones along the Neosho river is not well available for collecting purposes and was omitted. This region can be better studied on the Kansas river, which is probably not sufficiently distant to affect its fauna greatly. There are about three strata of limestone with thin shales between exposed in the northeast part of Emporia. While the fossils from the three horizons were kept separate, the lists are here combined.

Fusulina sp., c.
Sponge? sp.
Lophophyllum westii Beede.
Fistulipora nodulifera Meek.
Rhombopora sp.
Ambocœlia planoconvexa (Shumard), aa.
Chonetes granulifer Owen.
Hustedia mormoni (Marcou).
Productus semireticulatus (Martin).
sp.
Spirifer cameratus Morton, c.
Spiriferina kentuckiensis (Shumard).
Nuculana bellistriata attenuata Meek, a.
Bellerophon bellus Keyes ?.
Gastropod, two species.
Loxonema sp.
Murchisonia sp.
Naticopsis altonensis McChesney ?.
Pleurotomaria brazoensis Shumard ?.
perhumerosa Meek, aa
Soleniscus? sp.
Strophostylus nanus (M. & W.)?, c.
Aganides sp., c.
Gastrioceras sp., a.

ELMDALE FORMATION.

The following is a rough section measured rapidly for the purpose of assigning definite horizons for the fossils collected:

		Feet.	Inches.
22.	Limestone (Neva)	4+	...
21.	Shales	8	...
20.	Impure limestone	1	6
19.	Shale	3	8
18.	Slabby limestone	5	...
17.	Blue, shaly limestone	2	4
16.	Hard, calcareous shale	3	...
15.	Slabby limestone	5	...
14.	Olive shales	7	...
13.	Blocky stuff	3	...
12.	Clay with crusty sheets	2	2
11.	Shale	5	...
10.	Limestone	6	...
9.	Shales	2	...
8.	Clayey limestone	0	8
7.	Green shales	8	...
6.	Thinly bedded buff limestone, with crusty seams	3	...
5.	Olive shales	4	6
4.	Limestone	0	4
3.	Shales	2	...
2.	Limestone	1	2
1.	Shale	2	...

The lowest number (1) is well up in the formation. The remaining portion is not exposed in place, and, indeed, none of it but the *Fusulina* zone is exposed at all. No. 1 is the lowest shale, shown in the road just east of the bridge. The formation is considered as running down to the water's edge below the bridge. The rock on which the dam is built is probably the Americus limestone. The *Fusulina* horizon is considerably above this, and about an equal amount below the base of the section given. The section is located at the type locality of the formation, on the Cottonwood Falls road at the river bluff east of Elmdale.

FUSULINA HORIZON.

Fusulina sp., aa.
Lophophyllum profundum E. & H.
Crinoid spines, two species.
Archæocidaris spinoclavata M. & W.
triserrata Meek.
two species.
Fenestella sp.
Fistulipora nodulifera Meek.
Meekopora prossseri Ulrich.
Rhombopora sp.
Septopora biserialis (Swallow).
Chonetes glaber Geinitz.
granulifer Owen.
Hustedia mormoni (Marcou).
Productus sp.

Pugnax utah (Marcou).
Rhipidomella pecosi (Marcou).
Seminula argentea (Shepard), c.
Spirifer cameratus Morton.
Spiriferina kentuckiensis (Shumard).

No. 10.

Archæocidaris sp.
Fenestella sp.
Ambocœlia planoconvexa (Shumard).
Chonetes sp.
Hustedia mormoni (Marcou).
Meekella striaticostata (McChes.)
Pugnax utah (Marcou).
Seminula argentea (Shepard).

No. 11.

Fusulina sp.
Aulopora? anna Beede.
Archæocidaris sp.
Fistulipora nodulifera Meek.
Meekopora prosseri Ulrich.
Septopora biserialis (Swallow).
Chonetes granulifer Owen.
Hustedia mormoni (Marcou).
Productus semireticulatus (Martin), c.
Pugnax utah (Marcou), c.
Seminula argentea (Shepard), c.
Spirifer cameratus (Morton), c.

No. 15.

Productus nebrascensis Owen.
Aviculopecten occidentalis Shum., a.
maccoyi M. and H.
Pseudomonotis hawni (Meek), a.

No. 17.

Fenestella sp.
Rhombopora sp.
Septopora biserialis (Swallow).
Streblotrypa prisca (Gabb and Horn).
Derbya crassa (Meek).
Productus nebrascensis Owen.
Seminula argentea (Shepard), c.
Aviculopecten occidentalis Shumard.
Myalina sp.

NEVA LIMESTONE.

A comparatively thin limestone, in two layers, aggregating about ten feet in thickness. Locality, top of previous section (22).

Fusulina sp.
Pinnatopora sp.
Ambocœlia planoconvexa (Shumard).
Seminula argentea (Shepard).

ESKRIDGE SHALES.

About thirty feet of non-fossiliferous shales.

COTTONWOOD LIMESTONE.

Six feet or more of white, slightly cherty, foraminiferal limestone, in two layers. Quarries east of Cottonwood Falls.

Fusulina sp., aa.
Lophophyllum profundum Milne, Edwards and Haime.
Archæocidaris sp.
Cystodictya inequimarginata Rogers.
Fenestella limbata Foerste.
remota Foerste.
Fistulipora nodulifera Meek.
Pinnatopora sp.
Rhabdomeson americanum Rogers.
Rhombopora lepidodendroides Meek.
Septopora biserialis (Swallow).
Streblotrypa prisca (Gabb and Horn).
Chonetes granulifer Owen.
Pinna sp.
Griffithides scitula (Meek and Worthen).

Florena Member, Garrison Formation.—Calcareous, highly fossiliferous shales from six to ten feet in thickness, resting on the Cottonwood limestone. Quarries east of Cottonwood Falls.

Fusulina sp.
Lophophyllum profundum (Edwards and Haime).
Ceriocrinus hemisphæricus (Shumard).
Archæocidaris sp.
Fenestella limbata Foerste, c.
remota Foerste.
Fistulipora nodulifera Meek, c.
Meekopora prosseri Ulrich, c.
Pinnatopora sp.
Rhombopora lepidodendroides Meek.
Septopora biserialis (Swallow), a.
Stenopora carbonaria Worthen, c.
Streblotrypa prisca (Gabb and Horn).
Thamniscus octonarius Ulrich, c.
Chonetes granulifer Owen, aa.
Crania modesta White and St. John.
Derbya crassa (Meek).
sp.
Meekella striaticostata (McChesney), c.
Productus cora d'Orbigny.
longispinus (Sowerby).
nebrascensis Owen, c.
semireticulatus (Martin), a.
sp.
Seminula argentea (Shepard), a.
Strophalosia sp.
Astartella sp.
Aviculopecten maccoyi Meek and Hayden.
Euomphalus sp.
Griffithides scitula (Meek and Worthen).

Neosho Member, Garrison Formation.—A series of shales and thin limestones about 100 feet thick.

Section at Crusher Hill, near Strong City.	Feet.	Inches.
16. Covered slope, with red and green shales at top	40	...
15. Limestone with interbedded shales	10	...
14. Shales	10	...
13. Greenish shales, with stratified limestones	5	...
12. Calcareous slabby shales	8	...
11. Limestone	1	8
10. Shales, lower part gray, upper part buff	5	...
9. Limestone	2	...
8. Shales, red, green, and buff	6	6
7. Buff concretionary rock	0	6
6. Bituminous and blue shales	10	...
5. Limestone	2	6
4. Shales with limestone streaks	12	...
3. Clayey, blocky limestone	0	5
2. Greenish shales	5	6
1. Limestone	2	...

The fossils of these horizons are here grouped in a single list.

Crinoid sp.
Archæocidaris sp.
Fenestella limbata Foerste.
Rhombopora sp., a.
Septopora biserialis (Swallow), c.
Stenopora carbonaria (Worthen), c.
Streblotrypa prisca (Gabb and Horn).
Thamniscus octonarius Ulrich, c.
Spirorbis sp., a.
Chonetes granulifer Owen, aa.
Derbya sp.
Meekella striaticostata (McChesney).
Productus nebrascensis Owen.
" semireticulatus (Martin).
Seminula argentea (Shepard).
Aviculopecten occidentalis Shumard, c.
Pelecypod sp.
Pseudomonotis hawni (Meek and Worthen).
Aclis? sp.
Bellerophon sp.
Gastropod, several species.
Griffithides scitula (Meek and Worthen).

PLATE XLI.

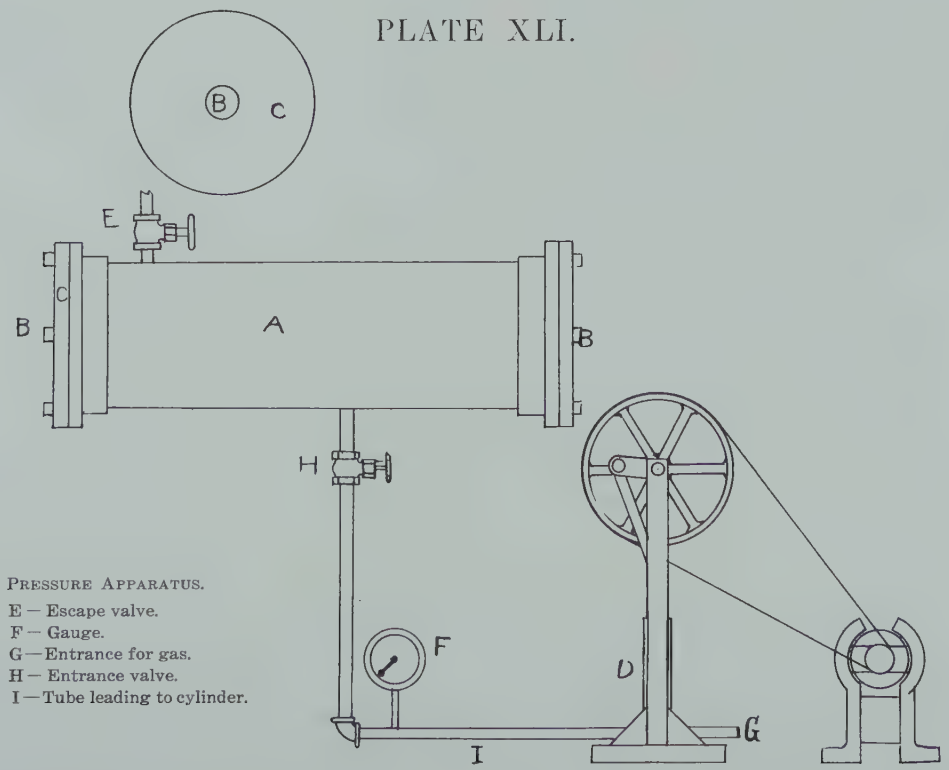


DIAGRAM OF THE PRESSURE APPARATUS.

A — Cylinder.
B — Glass window.
C — End cap.
D — Pump.
E — Escape valve.
F — Gauge.
G — Entrance for gas.
H — Entrance valve.
I — Tube leading to cylinder.

PLATE LXII.

Lampsilis recta, female, with shell structures indicated.

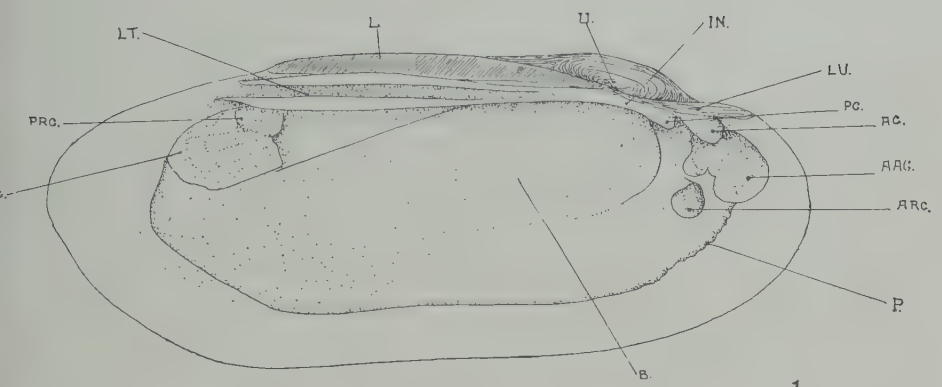
FIGURE 1.

AAC	Anterior adductor cicatrix or scar.
AC	Anterior pseudocardinal.
ARC	Anterior retractor cicatrix.
B	Branchial depression.
IN	Interdentum.
L	Ligament.
LT	Lateral teeth or laterals.
LU	Lunule.
P	Pallial line.
PAC	Posterior adductor cicatrix.
PC	Posterior pseudocardinal.
PRC	Posterior retractor cicatrix.
U	Umbone or beak.

FIGURE 2.

A	Anterior margin.
AS	Anterior slope.
B	Beak or umbone.
DM	Dorsal margin.
L	Ligament.
LF	Lateral furrow.
LS	Lateral slope.
LU	Lunule.
PM	Posterior margin.
PS	Posterior slope.
PU	Posterior umboidal ridge.
V	Ventral margin.

PLATE LXII.



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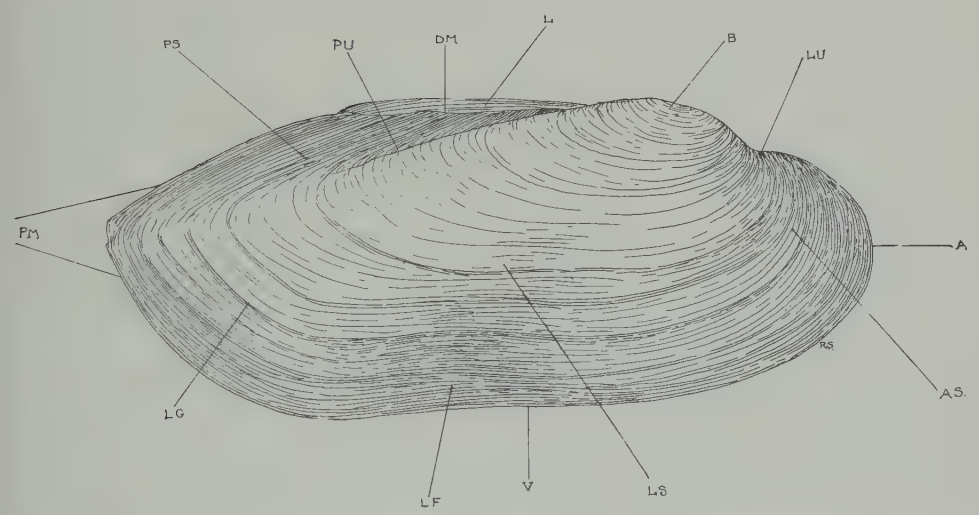

2

PLATE LXIII.

FIGURE 1.—*Truncillo triquetra.* ♂
FIGURE 2.—*Lampsilis ventricosa.* ♀

PLATE LXIII.

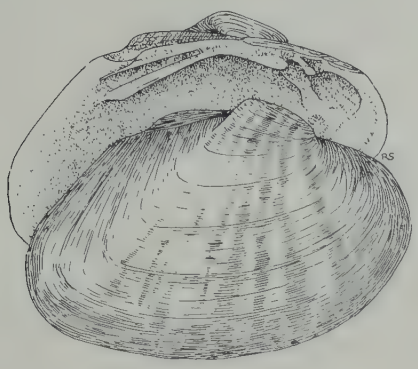

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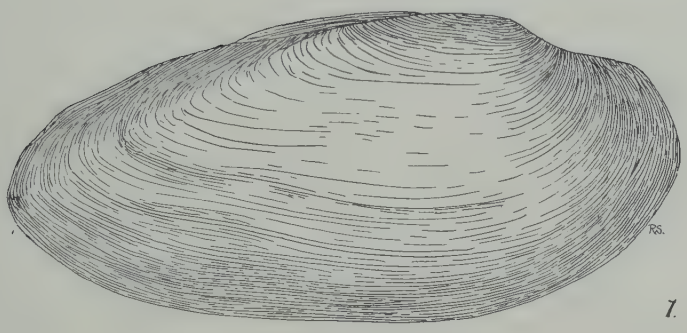
PLATE LXIV.

FIGURE 1.—*Lampsilis anodontoides.* ♂
FIGURE 2.—*Lampsilis luteola.* ♀

PLATE LXIV.



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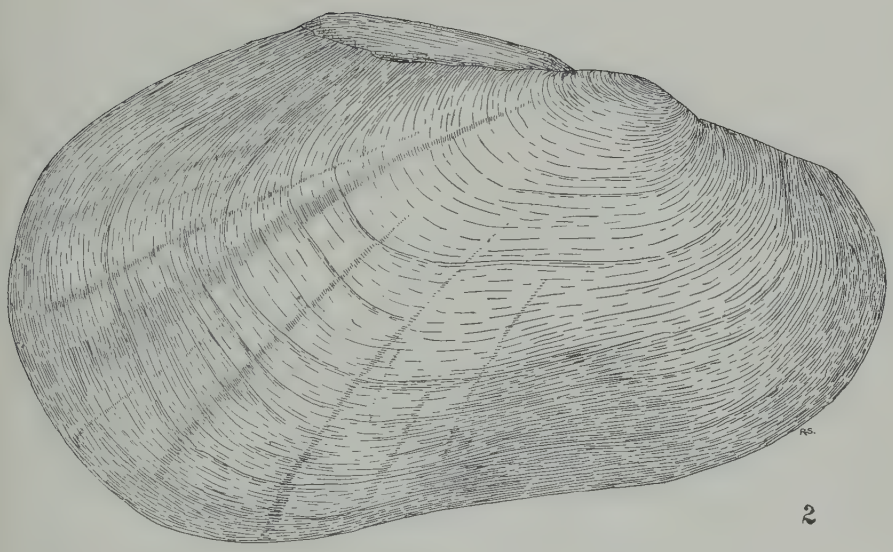

2

PLATE LXV.

FIGURE 1.—*Lampsilis ellipsiformis.* ♂

FIGURE 2.—*Lampsilis ligamentina.*

PLATE LXV.

1

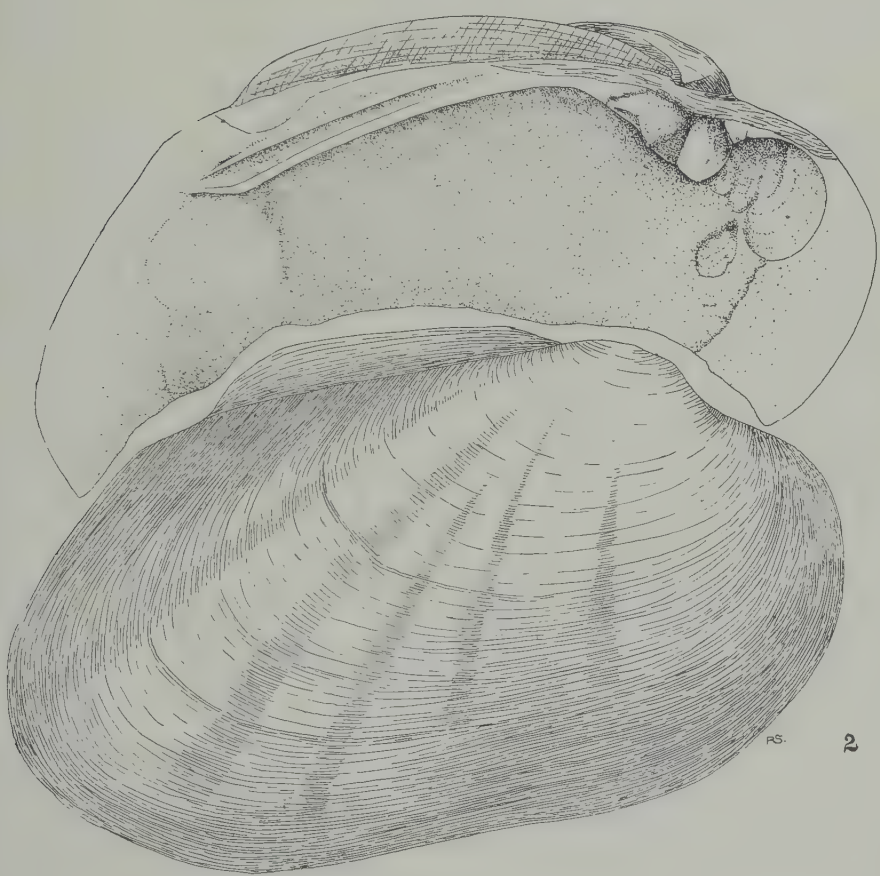

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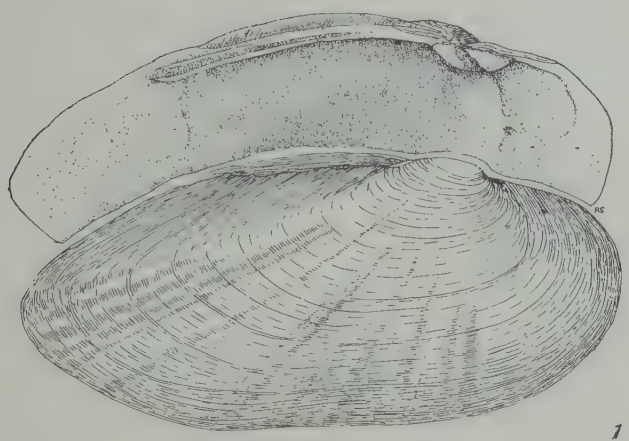
PLATE LXVI.

FIGURE 1.—*Lampsilis fallaciosa.* ♂
FIGURE 2.—*Lampsilis recta.* ♀

PLATE LXVI.



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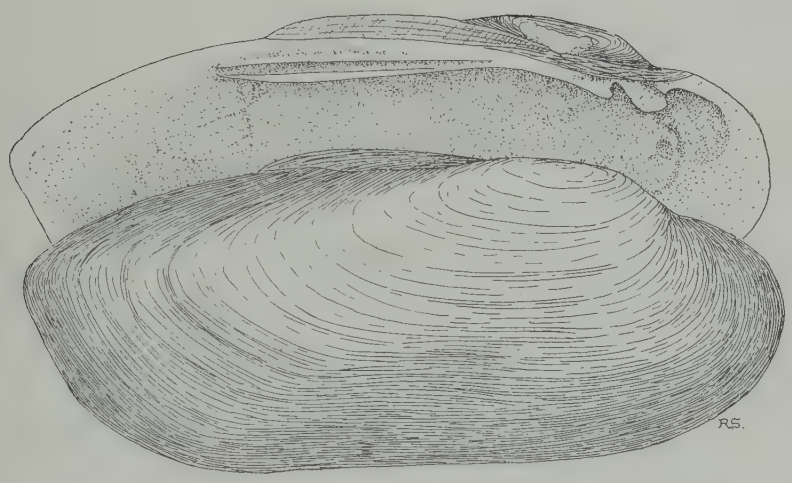
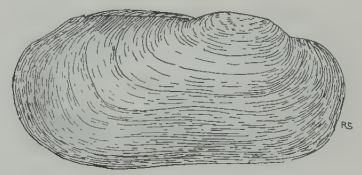


2

PLATE LXVII.

FIGURES 1 and 2.—*Lampsilis subrostrata.*
FIGURE 3.—*Lampsilis parva.*
FIGURE 4.—*Lampsilis gracilis* (juvenile).

PLATE LXVII.



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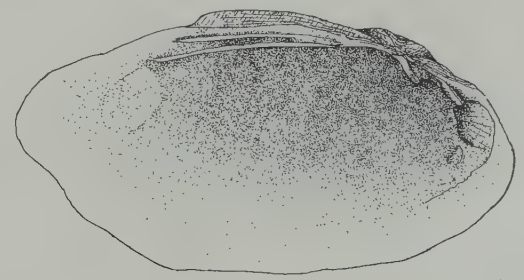

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PLATE LXVIII.

Lampsilis alata. ♂

PLATE LXVIII.

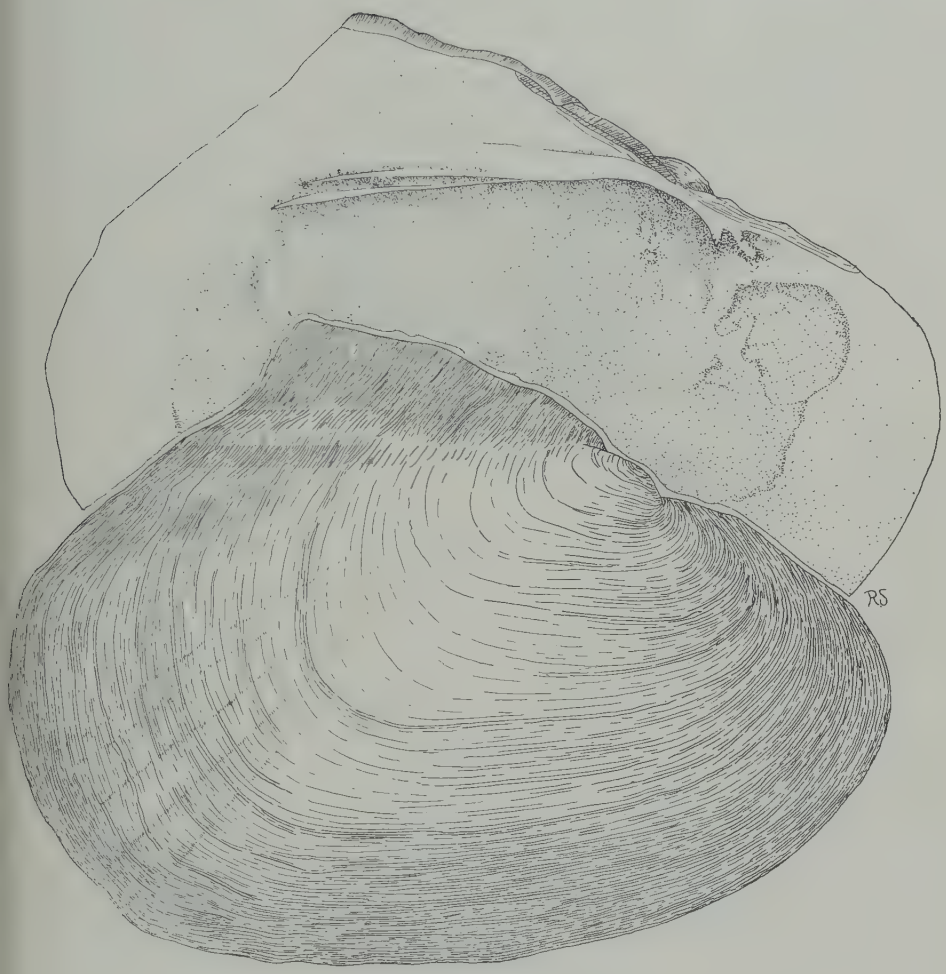

PLATE LXIX.

FIGURE 1.—*Plagiola securis.*
FIGURE 2.—*Obovaria ellipsilis.*

PLATE LXIX.

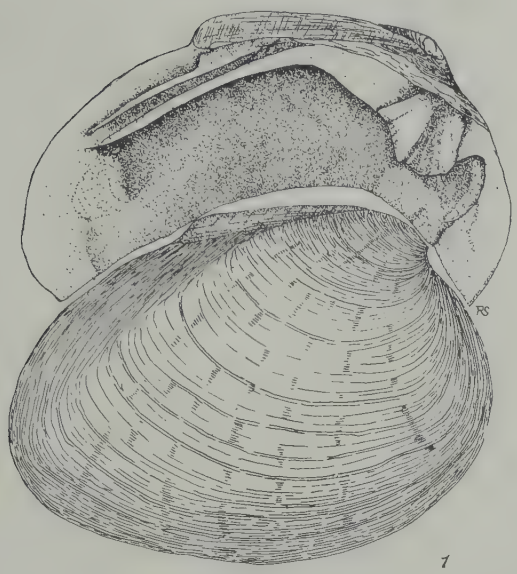

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PLATE LXX.

FIGURES 1 and 2.—*Plagiola donaciformis.*
FIGURE 3.—*Plagiola elegans.*
FIGURE 4.—*Tritogonia tuberculata.* ♂

PLATE LXX.

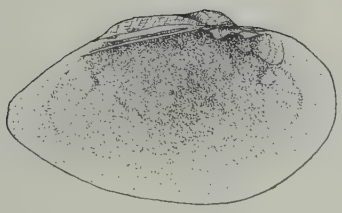

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PLATE LXXI.

FIGURE 1.—*Obliquaria reflexa.*
FIGURE 2.—*Cyprogenia alberti.*

PLATE LXXI.

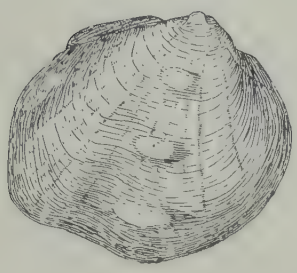

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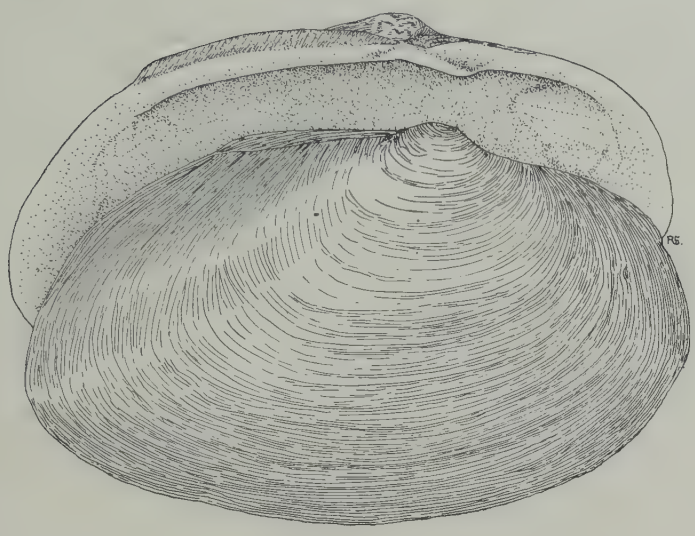
PLATE LXXII.

FIGURE 1.—*Strophitus edentulus.*
FIGURE 2.—*Ptychobranchus phaseolus.*

PLATE LXXII.



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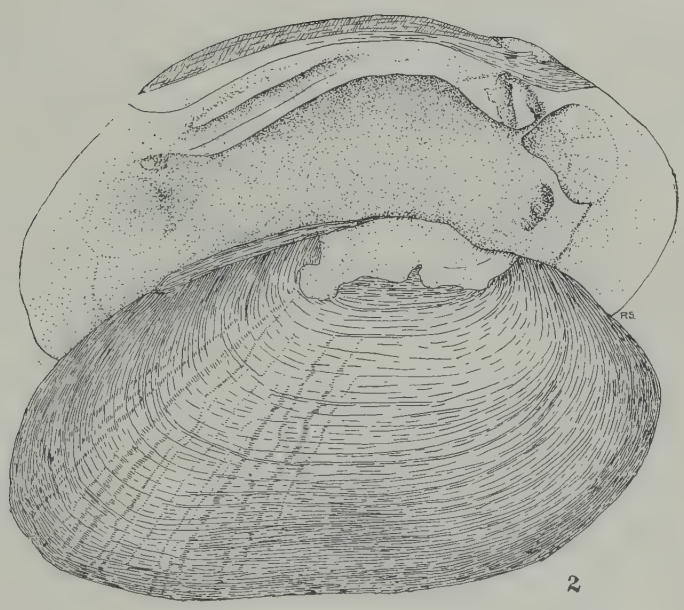

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PLATE LXXIII.

Anodonta suborbiculata.

PLATE LXXIII.

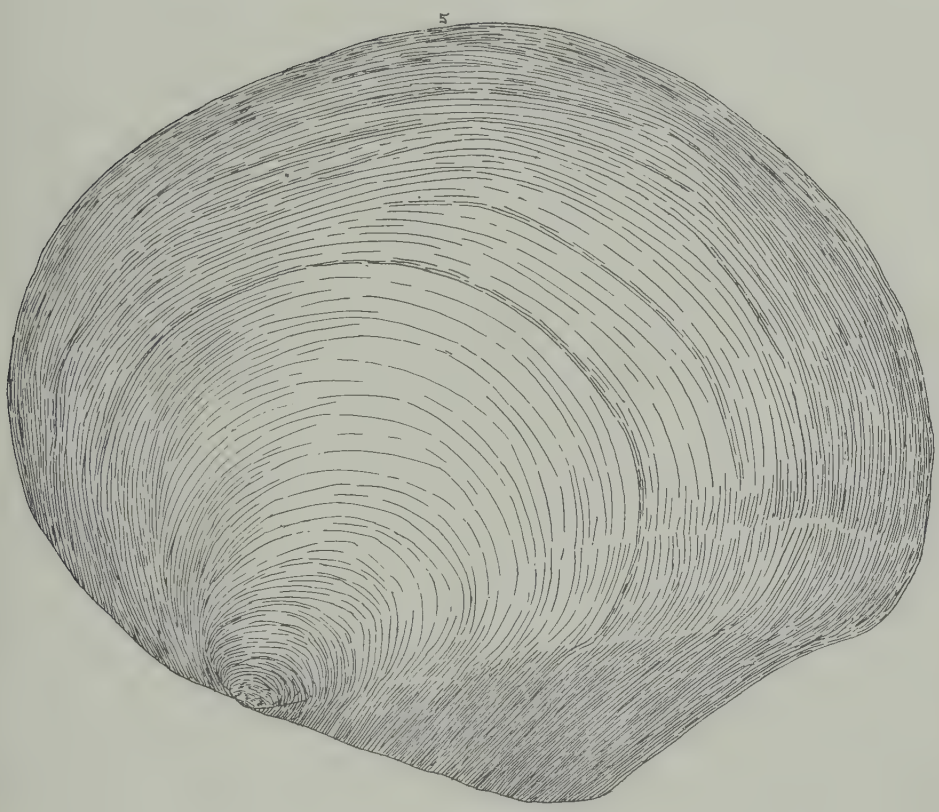
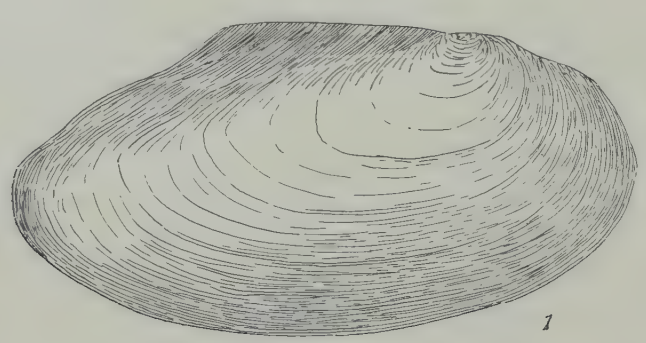


PLATE LXXIV.

FIGURE 1.—*Anodonta imbecillis.*
FIGURE 2.—*Anodontoides ferrussacianus.*
FIGURE 3.—*Anodonta grandis.*

PLATE LXXIV.



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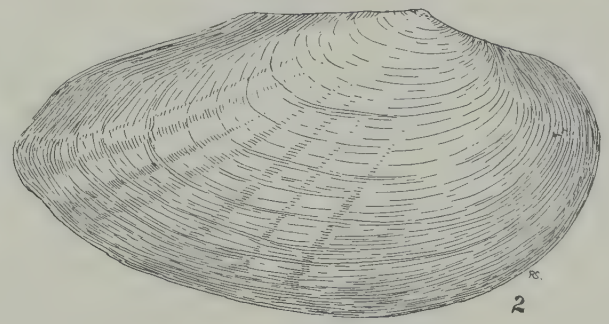

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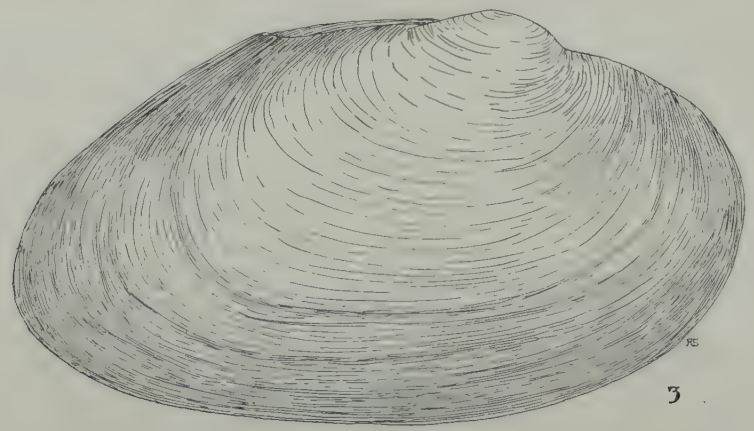

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PLATE LXXV.

Anodonta opaca.

PLATE LXXV.

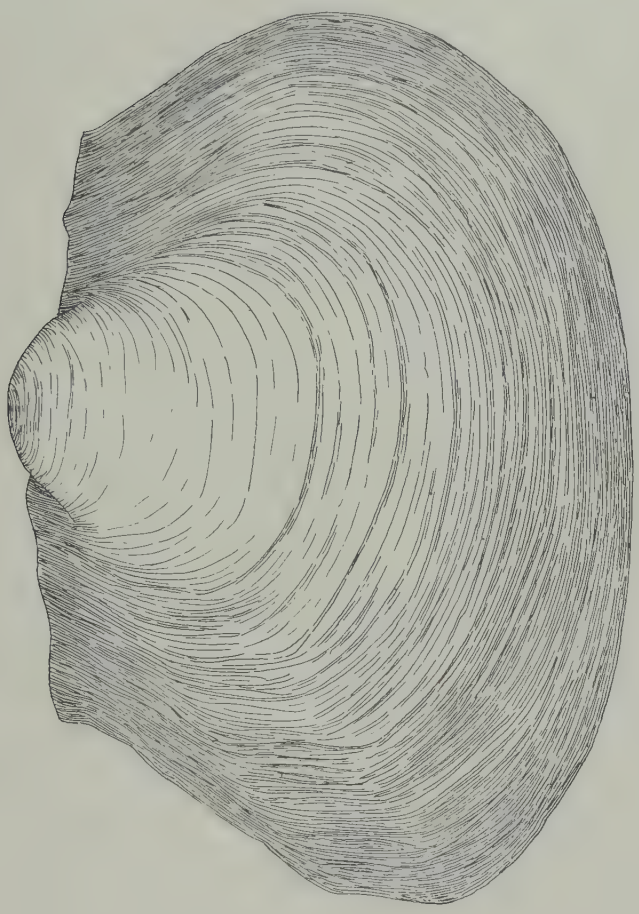
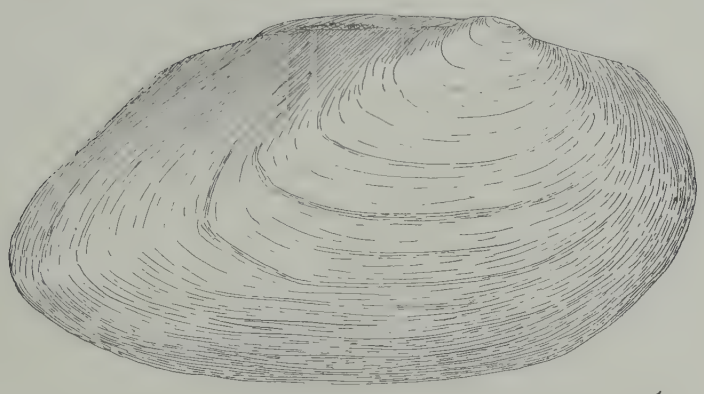


PLATE LXXVI.

FIGURE 1.—*Symphynota costa.*
FIGURE 2.—*Symphynota complanata.*

PLATE LXXVIII.



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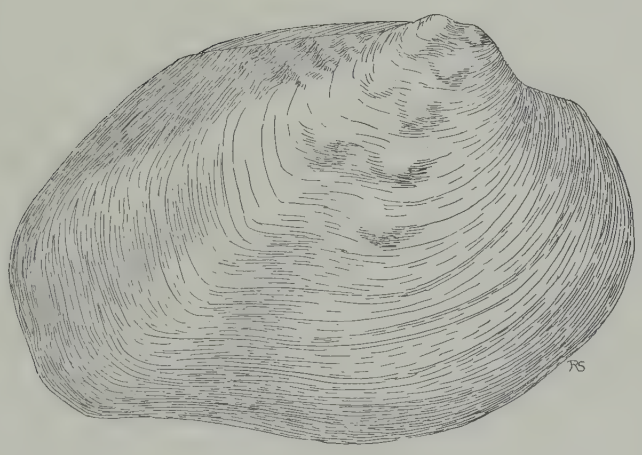


2

PLATE LXXVIII.

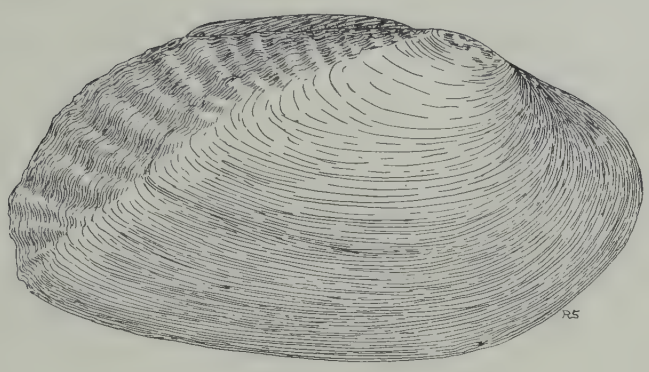
FIGURE 1.—*Unio tetralasmus.*
FIGURE 2.—*Pleurobema æsopus.*

PLATE LXXVII.

PLATE LXXVII.

Unio gibbosus.

PLATE LXXVI.



1

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PLATE LXXIX.

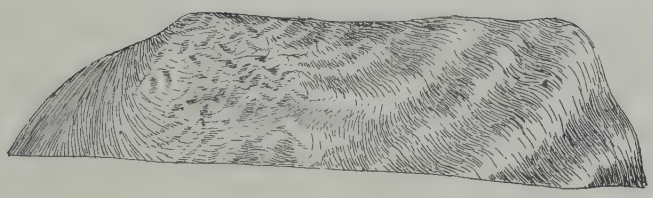
Quadrula plicata.

PLATE LXXIX.

PLATE LXXX.

FIGURE 1.—*Quadrula heros.*
FIGURE 2.—*Quadrula undulata.*

PLATE LXXX.



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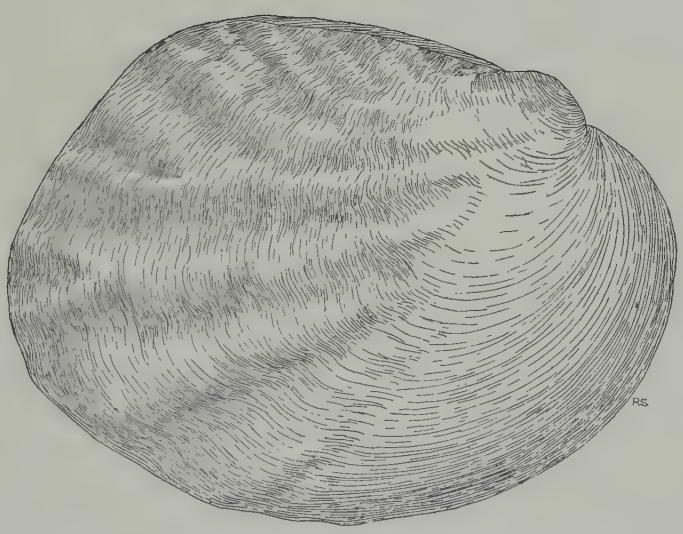

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PLATE LXXXI.

FIGURE 1.—*Quadrula metenevra.*
FIGURE 2.—*Quadrula cylendrica.*

PLATE LXXXI.

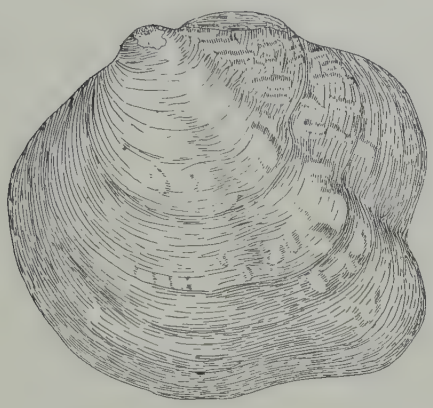

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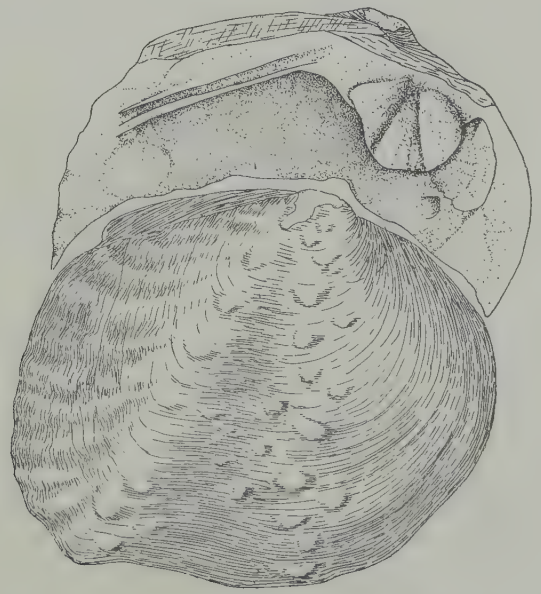
PLATE LXXXII.

FIGURE 1.—*Quadrula lachrymosa.*
FIGURE 2.—*Quadrula fragosa.*

PLATE LXXXII.

2



1

PLATE LXXXIII.

FIGURE 1.—*Quadrula postulata.*
FIGURE 2.—*Quadrula postulosa.*

PLATE LXXXIII.

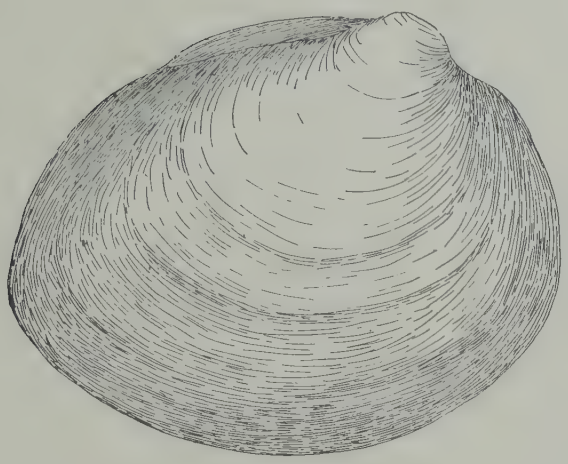
2

1

PLATE LXXXIV.

FIGURE 1.—*Quadrula coccinea.*
FIGURE 2.—*Quadrula rubiginosa.*

PLATE LXXXIV.



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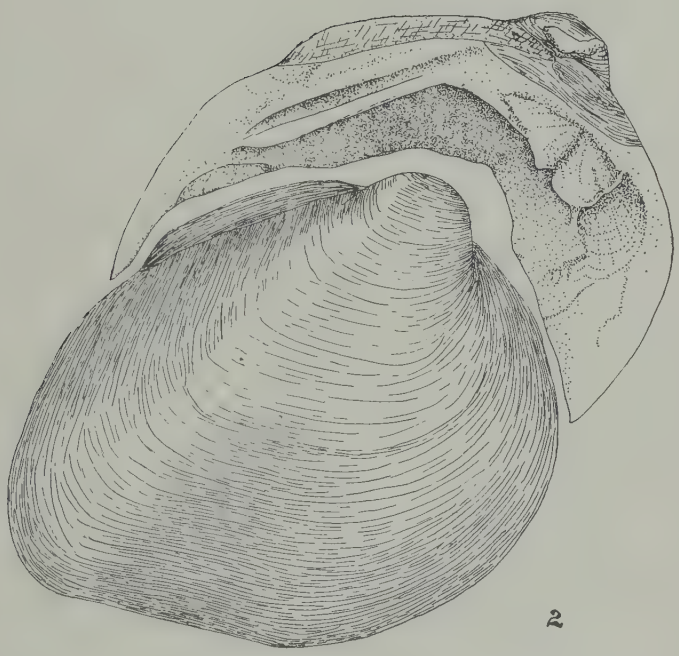

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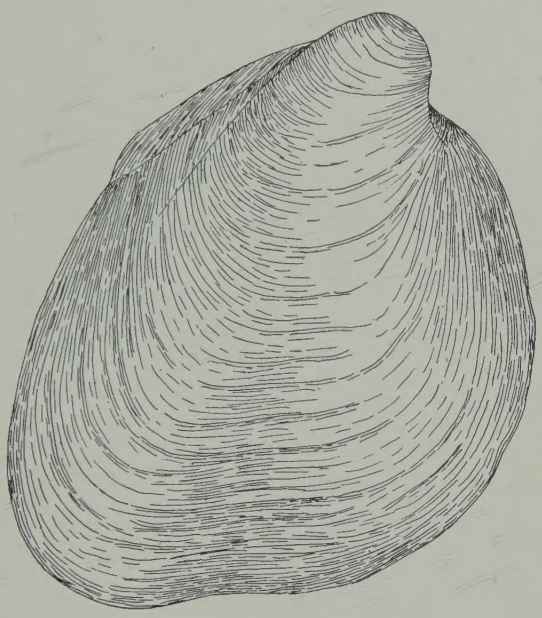
PLATE LXXXV.

Quadrula solida (juvenile).

PLATE LXXXV.



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